ABSTRACT

The invention is a recursive table-lookup decoding algorithm (RTLD alg.) and also a method of decoding parallel-concatenated convolutional codes (PCCC's) by utilizing the RLTD algorithm so as to not require a mathematical/computational processor. The invention's recursive table-lookup decoding algorithm approximates a maximum-a-posteriori (MAP or BCJR) decoder for convolutional codes. Parallel-concatenated convolutional codes (PCCC's) are error-correcting binary codes that are comprised of two or more constituent convolutional subcodes (encoders) which share the same block of information bits, but in different interleaved time-index orderings. Prior art of decoding devices for PCCC's require a mathematical/computational processor to perform computations such as multiplications and additions along with possibly other computations. The method of decoding PCCC's in this invention is summarized as taking quantized code symbols and iteratively performing the invention's recursive table-lookup decoding algorithm for each constituent convolutional subcode of the PCCC for a certain number of iterations whereby the decoded estimates for the information bits are obtained from a block of most-significant bits. The recursive table-lookup decoding algorithm recursively reads from a set of pre-stored lookup-tables. The invention includes a technique to create the binary address-words for accessing the lookup-tables. The invention's algorithm can be made to closely approximate the well-known MAP/BCJR decoding algorithm by appropriately pre-storing the set of lookup-tables. Moreover, the algorithm can be made to closely approximate modified versions of the BCJR algorithm that may be better at decoding specific PCCC's. The method of decoding in the invention can be

implemented in software or hardware. A hardware implementation of the invention's method of decoding would not require a mathematical/computational processor. The invention can be implemented with reasonably small sized lookup-tables for low-complexity PCCC's such as those with 2-state convolutional encoders.